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VOLUME IMPACT OF FUSIFORM RUST AS A COMPARISON OF ACTUAL YIELD FROM SLASH PINE PLANTATIONS IN CENTRAL LOUISIANA TO YIELDS PROJECTED USING AN IDEAL SURVIVAL MODEL FOR THE WEST GULF REGION

by

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Abstract

Comparisons between Central Louisiana slash pine plantations and projections from an ideal survival model indicated reductions in cubic foot volume of between 12.6 and 49.2 percent in 13-year old pairings and a reduction of 41.5 percent in one 18-year old pairing. Merchantable surviving stems were also reduced from 10 to 29 percent in three of the four plantations. The 13-year old and 18-year old Central Louisiana plantations averaged 60.8 and 62.1 percent fusiform rust stem cankering, respectively, while the ideal survival model was based on 25 percent or less stem cankering. In the 13-year age class volume reduction increased with increasing site index.

INTRODUCTION

In the winter of 1976-77 volume and rust condition class were measured in seven 13- to 18-year old slash pine plantations in Central Louisiana. In addition, site indices and initial planting density were obtained from the owners of the plantations. The purpose was to obtain volume impact due to fusiform rust as a comparison to some standard in which rust infection was low or non-existent. Data presented by Dell et al. (1979) were taken as the low infection standard (the ideal survival pattern). Volume data, not appearing in the original publication (for 13- and 18-year old plantations), were obtained for slash pine from Dell (pers. comm.).

In an earlier report (Affeltranger, 1979) Central Louisiana volume data did not correlate well with data from Coile and Schumacher's model (Coile and Schumacher, 1964). In the former report, however, volume figures had to be adjusted upward or downward 0.3 ft^3/average tree in a diameter class/year because only five year interval data were available.

With 13- and 18-year old data now available from Dell these adjustments are unnecessary and a more accurate comparison between Central Louisiana data and these data can be made.

MATERIALS AND METHODS

Measurements needed for projecting cubic foot volume were taken from plantations in Rapides, Allen and Beauregard Parishes, La. Diameter, height and form class data were taken on 13- and 18-year old slash pine. These data were then expanded using Louisiana volume tables (Minor, 1950).

These volume estimates, adjusted to a per acre basis, were then compared to the Dell et al. ideal survival model predictions. For each of four comparisons made, site index, initial planting density, species and age were the same (see Table 1, page 3). Three could not be compared because of inequalities in these criteria. Total tree height and volume inside bark were common criteria to both Minor's tables and the ideal survival model.

Establishment density at age 5 could not be obtained from these companies. Therefore, projections from age 5 to 15 which utilize transitional probabilities of rust associated mortality from a survival model developed by Nance et al. (unpublished report) could not be determined. Without projection of the data only direct comparisons in survival and volume could be made with Dell's low infection standard.

RESULTS

Data in Table 1, suggest that fusiform rust has a definite volume impact on the four plantations measured. Reduction in cubic foot volume in the three 13-year comparisons varied from 13 to 49 percent and was 42 percent for the one 18-year comparison.

Rust tree volume was observed to be lower than that projected by the Dell et al. model. Stem cankering (living and dead trees) ranged from 46 to 68 percent (average = 60.8) in 13-year old Central Louisiana plantations. The 18-year Central Louisiana plantation had 62 percent stem cankering. In both age classes ideal survival pattern plantations were considered to have 25 percent or less stem cankering (Feduccia, personal communication). Reduction of merchantable surviving stems was not proportional to volume reduction. Stem loss ranged to 29 percent.

DISCUSSION

In the Central Louisiana plantations, row plots were sampled. This method had not been used in most volume and yield work. However, assuming that fusiform rust infects trees in a random fashion, this sampling method should be valid to allow volume comparisons when initial planting density is equal for the paired values compared, even when volume tables were developed from plot rather than row data.

While fire was precluded from the plots used to develop the ideal survival model, prescribed burning was done on the plantations where our plots were located. While considered necessary to reduce wildfire and competition, controlled burning contributes to mortality when slash pine is heavily infected with fusiform rust.

TABLE 1. Merchantable volume (cubic feet), surviving merchantable stems and fusiform rust stem infection present in three 13-year old and one 18-year old comparisons of slash pine plantations in Central Louisiana and from an ideal surivival pattern (ISP) from the West Gulf Region (Dell, Ibid).

PLANTATION DESIGNATION	AGE	SITE INDEX (BASE AGE)	INITIAL PLANTING DENSITY	MERCHANTABLE VOLUME PER ACRE (CUBIC FEET-INSIDE BARK-TOTAL TREE HEIGHT)	SURVIVING MERCHANTABLE STEMS PER ACRE	STEM INFECTION (PERCENT)	VOLUME REDUCTION (PERCENT)	SURVIVING MERCHANTABLE STEM REDUCTION (PERCENT)
Rapides Parish	13	60 (25)	908	768	428	68.1	22.1	-1.9
ISP	13		1000	986	420	25		
Allen Parish	13	70 (25)	726	829	348	67.8	49.2	29.4
ISP	13		750	1632	493	25		
Beauregard Parish	13	50 (25)	726	418	228	46.4	12.6	10.0
ISP	13		750	478	252	25		
Beauregard Parish	18	70 (25)	726	1636	436	62.1	41.5	14.2
ISP	18		750	2797	508	25		

In the small number of 13-year plots compared in this evaluation, volume loss increased with increasing site index, and increased somewhat with increasing stem infection. Losses increased in the older plantation probably due to the larger volume base and greater amount of stem infection.

While it is difficult to correlate volume loss directly to stem infection, it can be inferred from these data that fusiform rust has a volume impact when comparing 13-year plots with high rates of stem infection to a volume table based on plots with a low rate of stem infection.

Unfortunately, projections to rotation age cannot be computed because of the change in rate of normal growth, ingrowth of residual stems and volume loss due to rust stem mortality between ages 13 and 25.

Trends or indications from data presented in this report are valid only for the West Gulf Region, particularly Central Louisiana where the vast majority of plots for the ideal survival model were taken (Dell et al., 1979). Further, contrary to current speculation, a reduction was noted in per tree volume; stands with high rates of infection had significantly lower average per tree volumes than stands with lower rates of infection. The current belief that infected trees show no volume reduction is not supported by these results. Reduction of both mean height and diameter was noted between the field data and the ISP projection for stand structure; obviously average individual tree volume was also lower.

LITERATURE CITED

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